

AMENDMENTS TO THE CLAIMS

Listing of claims

1. (Currently Amended) A method for balancing capacitors in a capacitor bank, comprising:

producing three voltage levels, inclusive of a relatively low voltage level, a relatively central voltage level and a relatively high voltage level, from a reference voltage source, to monitor the state of charge of the capacitors,

determining a capacitor voltage for each capacitor and comparing the determined voltages with the produced voltage levels;

indicating a correct charge for a capacitor when a corresponding capacitor voltage is determined to be between the ~~two relatively lower voltage levels~~ and the relatively central voltage level;

indicating a fault in a capacitor when a corresponding capacitor voltage is greater than the relatively highest voltage level; and

balancing the capacitors only when neither a correct charge nor a fault is indicated.

2. (Original) The method as claimed in claim 1, wherein a fault in a capacitor is indicated when a gradient of the capacitor voltage during the charging of the capacitor, exceeds a limit value.

3. (Original) The method as claimed in claim 1, wherein the voltage levels are supplied via optocouplers to an evaluation device.

4. (Original) The method as claimed in claim 1, wherein the reference voltage source uses a voltage present in the capacitor bank.

5. (Original) The method as claimed in claim 4, wherein a sum voltage across two capacitors in the capacitor bank is tapped off as a reference voltage source for balancing.

6. (Currently Amended) The method as claimed in claim 1, wherein, after charging the capacitors, normal operation is started for one capacitor when the corresponding capacitor voltage reaches the relatively lowest voltage level and before the corresponding capacitor voltage has reached the relatively central voltage level;

wherein balancing begins when the corresponding capacitor voltage has reached the relatively central voltage level, and ends when the capacitor voltage has once again reached the relatively lowest voltage level;

wherein, when the relatively lowest voltage level is reached once again, normal operation is once again started, and

wherein a fault is indicated upon reaching the relatively highest voltage level.

7. (Original) The method as claimed in claim 6, wherein, in order to start balancing operation, the capacitor voltages of all the capacitors are raised above the relatively central voltage level.

8. – 10. (Canceled).

11. (Original) The method as claimed in claim 2, wherein the voltage levels are supplied via optocouplers to an evaluation device.

12. (Original) The method as claimed in claim 2, wherein the reference voltage source uses a voltage present in the capacitor bank.

13. (Original) The method as claimed in claim 12, wherein a sum voltage across two capacitors in the capacitor bank is tapped off as a reference voltage source for balancing.

14. (Currently Amended) The method as claimed in claim 2, wherein, after charging the capacitors, normal operation is started for one capacitor when the corresponding capacitor voltage reaches the relatively lowest voltage level and before the corresponding capacitor voltage has reached the relatively central voltage level;

wherein balancing begins when the corresponding capacitor voltage has reached the relatively central voltage level, and ends when the capacitor voltage has once again reached the relatively lowest voltage level;

wherein, when the relatively lowest voltage level is reached once again, normal operation is once again started, and

wherein a fault is indicated upon reaching the relatively highest voltage level.

15. (Original) The method as claimed in claim 14, wherein, in order to start balancing operation, the capacitor voltages of all the capacitors are raised above the relatively central voltage level.

16. (Currently Amended) The method as claimed in claim 3, wherein, after charging the capacitors, normal operation is started for one capacitor when the corresponding capacitor voltage reaches the relatively lowest voltage level and before the corresponding capacitor voltage has reached the relatively central voltage level;

wherein balancing begins when the corresponding capacitor voltage has reached the relatively central voltage level, and ends when the capacitor voltage has once again reached the relatively lowest voltage level;

wherein, when the relatively lowest voltage level is reached once again, normal operation is once again started, and

wherein a fault is indicated upon reaching the relatively highest voltage level.

17. (Original) The method as claimed in claim 16, wherein, in order to start balancing operation, the capacitor voltages of all the capacitors are raised above the relatively central voltage level.

18. (Currently Amended) The method as claimed in claim 4, wherein, after charging the capacitors, normal operation is started for one capacitor when the corresponding capacitor voltage reaches the relatively lowest voltage level and before the corresponding capacitor voltage has reached the relatively central voltage level;

wherein balancing begins when the corresponding capacitor voltage has reached the relatively central voltage level, and ends when the capacitor voltage has once again reached the relatively lowest voltage level;

wherein, when the relatively lowest voltage level is reached once again, normal operation is once again started, and

wherein a fault is indicated upon reaching the relatively highest voltage level.

19. (Original) The method as claimed in claim 18, wherein, in order to start balancing operation, the capacitor voltages of all the capacitors are raised above the relatively central voltage level.

20. (Currently Amended) The method as claimed in claim 5, wherein, after charging the capacitors, normal operation is started for one capacitor when the corresponding capacitor voltage reaches the relatively lowest voltage level and before the corresponding capacitor voltage has reached the relatively central voltage level;

wherein balancing begins when the corresponding capacitor voltage has reached the relatively central voltage level, and ends when the capacitor voltage has once again reached the relatively lowest voltage level;

wherein, when the relatively lowest voltage level is reached once again, normal operation is once again started, and

wherein a fault is indicated upon reaching the relatively highest voltage level.

21. (Original) The method as claimed in claim 20, wherein, in order to start balancing operation, the capacitor voltages of all the capacitors are raised above the relatively central voltage level.

22. – 27. (Canceled)

28. (Currently Amended) A method for balancing capacitors in a capacitor bank, comprising:

determining a capacitor voltage for a plurality of the capacitors;

comparing the determined voltages with at least three voltage levels, inclusive of a relatively low voltage level, a relatively central voltage level and relatively high voltage level, from a reference voltage source;

determining a correct charge for a capacitor upon a corresponding capacitor voltage being between ~~two~~ the relatively lower voltage levels and the relatively central voltage level;

determining a fault for a capacitor upon a corresponding capacitor voltage being greater than ~~at~~ the relatively highest voltage level; and

balancing capacitors upon neither a correct charge nor a fault being determined.

29. (Original) The method as claimed in claim 28, wherein a fault in a capacitor is determined when a gradient of the capacitor voltage during the charging of the capacitor, exceeds a limit value.

30. (Original) The method as claimed in claim 28, wherein the voltage levels are supplied via optocouplers to an evaluation device.

31. (Currently Amended) The method as claimed in claim ~~1~~28, wherein the reference voltage source uses a voltage present in the capacitor bank.

32. (Original) The method as claimed in claim 31, wherein a sum voltage across two capacitors in the capacitor bank is tapped off as a reference voltage source for balancing.

33. (Currently Amended) The method as claimed in claim 28, wherein, after charging the capacitors, normal operation is started for one capacitor when the corresponding capacitor voltage reaches the relatively lowest voltage level and before the corresponding capacitor voltage has reached the relatively central voltage level;

wherein balancing begins when the corresponding capacitor voltage has reached the relatively central voltage level, and ends when the capacitor voltage has once again reached the relatively lowest voltage level;

wherein, when the relatively lowest voltage level is reached once again, normal operation is once again started, and

wherein a fault is determined upon reaching the relatively highest voltage level.

34. (Original) The method as claimed in claim 33, wherein, in order to start balancing operation, the capacitor voltages of all the capacitors are raised above the relatively central voltage level.

35. – 37. (Canceled)

38. (Currently Amended) An apparatus for balancing capacitors in a capacitor bank, comprising:

means for determining a capacitor voltage for a plurality of the capacitors;

means for comparing the determined voltages with at least three voltage levels, inclusive of a relatively low voltage level, a relatively central voltage level and a relatively high voltage level, from a reference voltage source;

means for determining a correct charge for a capacitor upon a corresponding capacitor voltage being between ~~two~~the relatively lower voltage levels and the relatively central voltage level;

means for determining a fault for a capacitor upon a corresponding capacitor voltage being greater than ~~a~~the relatively highest voltage level; and

means for balancing capacitors upon neither a correct charge nor a fault being determined.

39. (Original) The apparatus as claimed in claim 38, wherein a fault in a capacitor is determined when a gradient of the capacitor voltage during the charging of the capacitor, exceeds a limit value.

40. (Original) The apparatus as claimed in claim 38, wherein the voltage levels are supplied via optocouplers to an evaluation device.

41. (Original) The apparatus as claimed in claim 38, wherein the reference voltage source uses a voltage present in the capacitor bank.

42. (Original) The apparatus as claimed in claim 41, wherein a sum voltage across two capacitors in the capacitor bank is tapped off as a reference voltage source for balancing.

43. (Currently Amended) The apparatus as claimed in claim 38, wherein, after charging the capacitors, normal operation is started for one capacitor when the corresponding capacitor voltage reaches the relatively lowest voltage level and before the corresponding capacitor voltage has reached the relatively central voltage level;

wherein balancing begins when the corresponding capacitor voltage has reached the relatively central voltage level, and ends when the capacitor voltage has once again reached the relatively lowest voltage level;

wherein, when the relatively lowest voltage level is reached once again, normal operation is once again started, and

wherein a fault is determined upon reaching the relatively highest voltage level.

44. (Original) The apparatus as claimed in claim 43, wherein, in order to start balancing operation, the capacitor voltages of all the capacitors are raised above the relatively central voltage level.

45. (Currently Amended) An apparatus for balancing capacitors in a capacitor bank, comprising:

a series circuit, formed from a non-reactive resistor and a first transistor, arranged in parallel with at least two capacitors in the capacitor bank; and

at least one further transistor, connected in parallel with the first transistor, the transistors being connected to an evaluation device, wherein at least three voltage levels, inclusive of a relatively low voltage level, a relatively central voltage level and a relatively high voltage level, are produced from a reference voltage source, wherein a capacitor voltage is determined and compared to the at least three voltage levels, ~~and~~ wherein balancing of the capacitors begins when the capacitor voltage of all of the capacitors reaches at the relatively central voltage level and ends when the capacitor voltage of all of the capacitors reaches at the relatively lower voltage

level, and wherein a fault is indicated in a capacitor when a corresponding capacitor voltage is greater than the relatively high voltage level.

46. (Currently Amended) The apparatus of claim 45, wherein a correct charge for a capacitor is indicated when a corresponding capacitor voltage is determined to be between the ~~two~~ relatively lower voltage levels and the relatively central voltage level, and wherein a fault in a capacitor is indicated when a corresponding capacitor voltage is greater than the relatively highest voltage level.

47. (Original) The apparatus of claim 45, wherein voltage taps on the capacitors are connected to the evaluation device.

48. (Currently Amended) The apparatus of claim 45, wherein, when the relatively lowest voltage level is reached once again, normal operation is again started, and wherein a fault is indicated upon reaching the relatively highest voltage level.

49. (Currently Amended) A method for balancing capacitors in a capacitor bank, comprising:

determining a capacitor voltage of each capacitor in the capacitor bank;

comparing each capacitor voltage to at least three voltage levels, inclusive of a relatively low voltage level, a relatively central voltage level and relatively high voltage level, produced from a reference source; and

balancing the capacitors upon the capacitor voltage of all of the capacitors reaching at the relatively central voltage level and end the balancing upon the capacitor voltage of all of the capacitors reaching at the relatively lower voltage level; and

indicating a fault in a capacitor when a corresponding capacitor voltage is greater than the relatively high voltage level.

50. (Currently Amended) The method of claim 49, wherein, upon the relatively lowest voltage level being reached once again, normal operation is again started, and wherein a fault is indicated upon reaching the relatively highest voltage level.

51. (Currently Amended) The method of claim 49, further comprising:

determining a correct charge for a capacitor upon a corresponding capacitor voltage being between ~~two~~the relatively lower voltage levels and the relatively central voltage level;

determining a fault for a capacitor upon a corresponding capacitor voltage being greater than ~~at~~the relatively highest voltage level; and

balancing capacitors upon neither a correct charge nor a fault being determined.

52. (Currently Amended) An apparatus for balancing capacitors in a capacitor bank, comprising:

means for determining a capacitor voltage of each capacitor in the capacitor bank;

means for comparing each capacitor voltage to at least three voltage levels, inclusive of a relatively low voltage level, a relatively central voltage level and relatively high voltage level, produced from a reference source; and

means for balancing the capacitors upon the capacitor voltage of all of the capacitors reaching ~~at~~the relatively central voltage level and end the balancing upon the capacitor voltage of all of the capacitors reaching ~~at~~the relatively lower voltage level,

wherein a fault is indicated in a capacitor when a corresponding capacitor voltage is greater than the relatively high voltage level.

53. (New) An apparatus for balancing capacitors in a capacitor bank, comprising:
a series circuit formed from a non-reactive resistor and a first transistor, arranged in parallel with at least two capacitors in the capacitor bank; and

at least one further transistor, connected in parallel with the first transistor ;

wherein the transistors are connected to an evaluation device, wherein voltage taps on the capacitors are connected to the evaluation device, wherein at least three voltage levels, inclusive of a relatively low voltage level, a relatively central voltage level and a relatively high voltage level, are produced from a reference voltage source, wherein a capacitor voltage is determined and compared to the at least three voltage levels, and wherein a fault is indicated in a capacitor when a corresponding capacitor voltage is greater than the relatively high voltage level.

54. (New) The apparatus as claimed in claim 53, further comprising optocouplers, adapted to transmit the voltage levels to a bus system.

55. (New) The apparatus as claimed in claim 54, wherein a double coupler is used instead of three optocouplers.